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Impact of Gross Domestic Product, Government Capital Expenditure, Interest Rates and Remittance Inflow on Domestic Cement Consumption of Nepal

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ABSTRACT

Cement/Concrete is the second most consumed commodity in the world, right after water. Cement holds a pivotal role in the economic progress of any country. This study attempted to investigate the impact of certain macroeconomic variables on the domestic cement consumption of Nepal from the period of 2012 to 2022. The macroeconomic variables analyzed in this study were gross domestic product, government capital expenditure, interest rates and remittance inflow. With a positivism philosophy, this study was done using secondary data in a quantitative approach. Statistical tools like correlation, regression and ANOVA were used for the study. The correlation results showed a strong positive correlation between domestic cement consumption and macroeconomic variables gross domestic product, government capital expenditure and remittance inflow. The regression results showed that cement consumption was not responsive to the trends in interest rates and remittance inflow. To increase cement consumption and foster economic growth, it is recommended by the study to increase government capital expenditures and mobilize remittance inflow into capital formation rather than consumption.

Keywords: domestic cement consumption, government capital expenditure, gross domestic product, regression, remittance inflow

Introduction

From the start of the revolution of infrastructure around the world, with complicated architectural blueprints, huge structures, and other unimaginable establishments; all there lies to the creation of it, concrete lies in the second position right behind water as the most consumed commodity (Bediako et al., 2016). According to the Cement Industry Federation of Australia (CIFA), a typical family home construction requires around 14 metric tons, and a kilometer of a typical freeway requires 2,500 metric tons of cement (Banstola et al., 2021). This highlights the importance of cement as a commodity product for the infrastructural development and economic progress of a nation.

As mentioned by Nepal Rastra Bank (NRB, 2021), the per capita cement consumption of Nepal is 303 kg which is extremely low compared to its neighboring country Bhutan with 734 kg per capita cement consumption. With the above data and anticipation from many mega projects in progress like the Gautam Buddha Regional International

Airport, Pokhara Regional International Airport, Kaligandaki Gorge Hydropower Project. the demand for cement is likely to increase (NRB, 2021). The population density of Nepal is nearly 10 times that of Bhutan which should further push cement demand for infrastructural and housing use cases in Nepal comparatively. Hence, there remains a major significance of this study for managerial implication in cement manufacturing companies, policy making and investment decision making.

Problem Statement

Many researchers have made remarkable efforts on the study of cement industry and have provided valuable insights over the domain. Numerous study have been conducted regarding the impact of macroeconomic variables in cement prices, financial performance of cement manufacturing companies and stock returns of cement manufacturing companies like (Bediako et al., 2016; Ibrahim & Sidam, 2021; Salisu et al., 2022).

Studies relating the handling behavior of cement, cost effectiveness in cement brands have also been the subject of numerous articles like (Mishra & Chaudhary, 2018 a & b; Gurloveleen & Bhatia, 2015). However, we have not encountered relevant study in the impact of multiple macroeconomic variables on cement consumption.

(Department of Industry, 2019) remains partly significant to our area of study, with findings stating an increase in the GDP growth rate by a percentage point will increase the cement demand by 4.79%. There remains a lack of proper study of the impact of cement consumption on other macroeconomic variables like government capital expenditure, interest rates and remittance inflow. The study by (DOI, 2019) was also conducted using the dependent variable "cement demand" which differs from the variable observed in our study "cement consumption". Moreover, a shorter period of data was analyzed, back in 2019 which might have divergent outcomes with the present and wider range of data.

In the light of these study and findings, it is important to further investigate on the impact of more of such macroeconomic variables on the domestic cement consumption of Nepal. The main reason for such an importance is because cement demand/consumption cannot logically be solely dependent upon one single macroeconomic variable like the gross domestic product. Surely, there must be other hidden relationships between other macroeconomic variables.

By conducting this study, we hope to contribute to the understanding of the relationship between macroeconomic variables (like gross domestic product, government capital expenditure, interest rates and remittance inflow) in the domestic cement consumption of Nepal. The findings of this study provide valuable insights for managerial implications in cement manufacturing companies, regulatory reference/policy making, business development, investment decision making for ventures and equities in cement manufacturing companies.

Research Objective

Despite the findings of significant literature, the influence of other macroeconomic variables on the cement consumption of Nepal remains a question, thereby the major objective of our study. With that, the overall objective of the study is to analyze the impact of gross domestic product, government capital expenditure, interest rates and remittance inflow on domestic cement consumption of Nepal.

Literature Review

Maskey and Mishra (2018) focuses productivity in construction through cement consumption. Bediako et al. (2016) over their study of relationship between macroeconomic variables and cement prices in Ghana found out that cement prices held no significant relationship with interest rates. A similar inference was made to variables like inflation rate and monetary policy rates with cement prices. However, a significant relationship was found between the cement prices and exchange rate of Ghana over their period. This was validated by the over dependence of

the country on imported clinker and gypsum. With such a reference, exchange rate could have been a great variable for our study, but it must be omitted due to the rapid decline and leap towards import independence of clinkers in the recent years of Nepal and a pegged currency with India with whom Nepal heavily relies on for approximately half of its trade/imports.

Ibrahim and Sidam (2021) in their analysis of relationship between financial performance of cement manufacturing companies with macroeconomic variables, it was observed that Gross Domestic Product held a significant positive impact on the return on assets of cement manufacturing companies in Nigeria. In the same article, it was observed that interest rates held significant negative impact on return on assets of cement manufacturing companies in Nigeria.

As per empirical studies like (Liu et al., 2008; Njoku et al., 2014), there remains a positive relationship between the output of manufacturing sectors and government capital expenditure. Similarly, this study also aims to look over the impact in cement consumption by the government capital expenditure of Nepal and establish a relationship if explainable.

There exists a long-run relationship and positive correlation between government expenditure and economic growth (Oladele et al., 2017). As DOI (2019) mentions, there is a significant and explainable relationship between economic growth and cement demand. This highlights a possible relationship between government capital expenditure and cement consumption. Logically, an increase in infrastructures like bridges, roads and buildings from government capital expenditure leads to an increase in domestic cement consumption (Rajan et al., 2005; Barajas et al., 2009). In the study of the impact of migrant's remittance over economic growth mention that decades of remittance credit in the economy have contributed little to economic growth in remittance-receiving countries and in some cases might have even retarded the growth. Nepal being a country highly reliant on its remittance inflow, such a variable's study remains very important. Despite such a negative standpoint, the empirical study's focus remains on capital formation, however our study remains on necessary consumption of the remittance recipients. This differentiates the focuses of both the studies thereby creating a scope of further research.

Hoermann and Kollmair (2009) in the study of labor migration and remittance inflow, state that recipients in the highlands of North-West Frontier Province and Asad Kashmir have evolved to cement-built houses from their previous ones built using loose stone and mud. Nepal being a country highly reliant on remittance inflow, there is a need for the study of such an objective. This highlights the importance of remittance in the cement consumption of Nepal and further increases the importance of such a study.

Empirical data and study on remittance of Nepal like (Chaudhary, 2022; CBS, 2011; NRB 2012; NRB, 2016; NRB, 2020) state that only about 3.5% of the total remittance credit in Nepal are used to finance businesses and capital formation to create value and over 70% of such remittances are used for consumption in daily life.

Interest rates drive the housing cycle along with the consumer durables cycle (Leamer, 2007). A retrospect from the 2007/2008 global financial crisis, an attractively low interest rate would create sub-prime and speculative credit facility to borrowers, thereby fueling housing demand in the economy (Mallick & Mahalik, 2010; Smith & Smith, 2006; Smith et al., 1988). As an economy goes through prosperity, banks and capital providers compete for investments, thereby cutting their demanded returns and interest rates, which results in risky investments and bad loans, this leads to a rise in risk averseness and scarcity of capital, resulting in increased interest rates which causes the credit cycle (Marks, 2018). This points to the impact of interest rates on the housing market thereby, cement consumption and the overall economy.

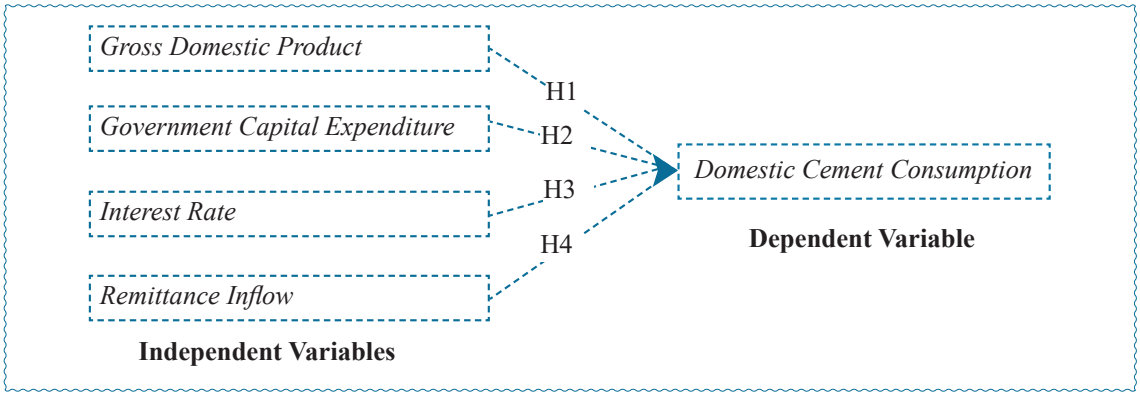
DOI (2019) mentions there is an existence of a significant and explainable relationship between economic growth (i.e. GDP growth percent) and

cement demand. This article states that a percentage point increase in the GDP growth rate will increase the cement demand by 4.79%. Research Gap

Despite many studies conducted in the realm of macroeconomic impacts on numerous factors related to cement as discussed in the literature, there exists a specific research gap in the impact of macroeconomic variables on cement consumption. Hence, the study aims to fill the gap by providing evidence from Nepal.

Figure 1

Conceptual Framework



In this study, the independent variables are Gross Domestic Product, Government Capital Expenditure, Interest Rates and Remittance Inflow whereas, the dependent variable in the study is Domestic Cement Consumption.

Variables

Gross Domestic Product. Gross Domestic Product, shortly GDP, is an economic measure of the total monetary value of all the goods and services produced withing the boundaries of a country in a time period, typically a year (O'Neill, 2014). Cement being an important commodity manufactured by Nepal, it is reflected significantly in the country's GDP. In this study, GDP remains an independent variable because it is theoretically, the cause not an effect of cement consumption.

Government Capital Expenditure. Government Capital Expenditure is the amount spent by the government of a country on capital projects (such as buildings, roads, bridges) which are economically impactful, durable and create long term value compared to government expenses for daily activities i.e. government recurrent expenses (Emmanuel & Oladiran, 2015). The common sources of government capital expenditure are government revenue, foreign aid and grants, and government debt.

Interest Rates. Interest Rates are the financial charges levied upon the creation of credit in a transaction that is set, monitored and managed by the central bank (Bediako et al., 2016). Easy/ cheap access to capital and credit is possible with low interest rate periods which tends to increase the consumption capacity of individuals and institutions (Marks, 2011). Cement being one of the most consumed commodities, the relationship of interest rates with cement consumption is imaginable.

Remittance Inflow. Remittance Inflow refers to the transfer of funds from international migrants to their family members in the migrant's home country (Barajas et al., 2009; World Bank, 2006; World Bank, 2009). Remittance Inflow is one of the major sources of cash flow for developing countries and Nepal being a developing country, such a variable is important to examine.

Domestic Cement Consumption. Domestic Cement Consumption is the total amount of cement consumed in a particular period (here, fiscal year) in a particular country. As per (DOI, 2019), it is the net of cement produced and imported by the country.

Hypothesis

H1: There is a significant relationship between Gross Domestic Product and Domestic Cement Consumption of Nepal

H2: There is a significant relationship between Government Capital Expenditure and Domestic Cement Consumption of Nepal

H3: There is a significant relationship between Interest Rates and Domestic Cement Consumption of Nepal

H4: There is a significant relationship between Remittance Inflow and Domestic Cement Consumption of Nepal

Methodology

Research Philosophy and Design

As the study is based upon statistical analysis of macroeconomic data and has hypothesis testing involved, we have adopted a positivism research philosophy. Over to the research approach, we have adopted an abductive research approach since we aim to provide theoretical explanations for our observations along with the quantitative strategy. Since we are analyzing a limited set of data and not updating with time, a cross sectional time horizon is chosen.

Study Area and Variables

The study was conducted over the period of 10 years from fiscal year 2012/13 AD to fiscal year 2021/22 AD. The variables set for the study are domestic cement production, interest rate (weighted average base rate of commercial banks), government capital expenditure, gross domestic product, and remittance inflows in the defined period. Among the above-mentioned variables, domestic cement production is considered a dependent variable whereas interest rate (weighted average base rate of commercial banks), government capital expenditure, gross domestic product growth rate and remittance inflows are considered independent variables.

Data Collection

All the required data for the study were collected from reports and publishes from respective government agencies like the central bank of Nepal (Nepal Rastra Bank), Nepal's Ministry of Finance, Customs Department of Nepal, the Central Bureau of Statistics of Nepal, and Nepal's Department of Industry. All the data used in the study are secondary in nature as they were retrieved from the above-mentioned sources and none of the data was collected from primary sources. The Domestic Cement Consumption data was taken in metric ton (MT) and it is an aggregate of the total cement produced in Nepal and imported by Nepal in the given period. Gross Domestic Product, Government Capital Expenditure and Remittance Inflow are all in million Nepalese rupees figures. And, since Nepal has mostly been in a base rate plus premium credit system, the Interest Rate taken for the study is the weighted average base rate of all commercial banks in the given period as published by the central bank.

Table 1

Relation of Cement Consumption and Remittance

FY (in BS)	FY (in AD)	Domestic Cement Consumption (MT)	Gross Domestic Product (NPR million)	Government Capital Expenditure (NPR million)	Interest Rate (WA Base Rate of CB)	Remittance Inflow (BPM 6)
2069/70	2012/13	1,407,662.63	1,949,294.82	54,598.43	9.83%	434,581.70
2070/71	2013/14	1,589,824.30	2,232,525.28	66,694.73	8.36%	543,294.10
2071/72	2014/15	1,431,294.41	2,423,638.48	88,754.71	7.88%	617,278.80
2072/73	2015/16	1,517,954.06	2,608,184.44	122,350.43	6.54%	665,064.35
2073/74	2016/17	2,442,944.46	3,077,144.92	208,749.40	9.89%	695,452.40
2074/75	2017/18	3,215,038.73	3,455,949.29	270,713.70	10.47%	755,058.58

FY (in BS)	FY (in AD)	Domestic Cement Consumption (MT)	Gross Domestic Product (NPR million)	Government Capital Expenditure (NPR million)	Interest Rate (WA Base Rate of CB)	Remittance Inflow (BPM 6)
2075/76	2018/19	3,370,765.46	3,858,930.40	241,562.50	9.57%	879,367.15
2076/77	2019/20	2,183,516.98	3,888,703.65	189,140.10	8.50%	875,026.96
2077/78	2020/21	2,783,512.05	4,352,550.24	228,836.10	6.86%	961,054.58
2078/79	2021/22	2,833,278.59	4,933,696.58	216,213.00	9.54%	1,007,306.87

Data Analysis and Findings

For the analysis of the collected data, we used Microsoft Excel and SPSS as the data analytics and statistical processing tools. Statistical methods like correlation, regression and ANOVA were used to process and justify the data into meaningful outcome. (Rezina et al., 2020; Vaidya & Paudel, 2022; Hoque, 2015; Aryal, 2020) have adopted similar approaches for data analysis and methodology in their study. A similar approach applied in this study gives validity to the methodology.

Table 2

Descriptive Statistics of Variables

	Mean	Std. Deviation	N
Domestic Cement Consumption (MT)	2,277,579.17	759,959.04	10
Gross Domestic Product (NPR million)	3,278,061.81	984,067.44	10
Government Capital Expenditure (NPR million)	168,761.31	78,581.21	10
Interest Rate	8.74%	1.34%	10
Remittance Inflow (NPR million)	743,348.55	186,405.20	10

Table 2 depicts a descriptive analysis of the stated variables over the 10 years of observation. We observe that the 10-year average cement consumption in Nepal is about 2,277,579.17 metric tons with a standard deviation of 759,959.04 metric tons. Similarly, we can analyze the average gross domestic product, government capital expenditure, interest rate (in percent) and remittance inflow over the 10 years of observation.

Table 3

Correlation Analysis

Pearson Correlation	Domestic Cement Consumption (MT)	Sig. (1-tailed)
Domestic Cement Consumption (MT)	1.000	-
Gross Domestic Product (NPR million)	.785	.004
Government Capital Expenditure (NPR million)	.947	.000
Interest Rate	.431	.107
Remittance Inflow (NPR million)	.760	.005

Table 3 shows the correlation analysis between the variables of this study i.e. domestic cement consumption, gross domestic product, government capital expenditure, interest rates and remittance inflow. We can observe that there is a strong positive correlation shown by gross

domestic product, government capital expenditure and remittance inflow with domestic cement consumption with correlation of .785, .947 and .760 respectively. The existence of a strong positive correlation is validated by the respective p-value (significance) as it is less than .05 (5 percent) for the correlation held with the above three independent variables. The correlation between domestic cement consumption and interest rates is however considered insignificant, as the p-value (significance) is more than .05 (5 percent).

Table 4

Hypothesis Testing Results

Hypothesis	Sig.	Results
H1: There is a significant relationship between Gross Domestic Product and Domestic Cement Consumption of Nepal	.004	Do Not Reject
H2: There is a significant relationship between Government Capital Expenditure and Domestic Cement Consumption of Nepal	.000	Do Not Reject
H3: There is a significant relationship between Interest Rates and Domestic Cement Consumption of Nepal	.107	Reject
H4: There is a significant relationship between Remittance Inflow and Domestic Cement Consumption of Nepal	.005	Do Not Reject

Table 5

Regression Analysis

Coefficients					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	4,991,568.15	1,666,480.86		2.995	.040
Gross Domestic Product (NPR million)	1.62	0.58	2.096	2.797	.049
Government Capital Expenditure (NPR million)	11.98	1.85	1.238	6.459	.003
Interest Rate	-22,069,112.25	11,025,046.29	-.389	-2.002	.116
Remittance Inflow (NPR million)	-9.93	3.62	-2.435	-2.741	.052

Table 5 shows the regression analysis between the dependent variable and the independent variables of the study. This sets a regression equation for explaining the dependent variable with the help of independent variables. The regression coefficient for Gross Domestic Product is 1.62 and 11.98 for Government Capital Expenditure; both of which are significant as the p-value (significance) is less than .05 (5 percent). From the above table, the relationship held with Interest Rate and Remittance Inflow is not considered to be significant as the p-value (significance) is greater than .05 (5 percent). Hence, the regression equations from the study becomes $Y = 4,991,568.15 + 1.62*X_1 + 11.98*X_2$ where Y is the dependent variable (i.e. domestic cement consumption in metric ton), X_1 is the gross domestic product (in NPR million) and X_2 is the government capital expenditure (in NPR million).

Table 6

ANOVA[a]

Model	df	F	Sig.
Regression	5	55.093	.001b
Residual	4		
Total	9		

Table 6 shows the ANOVA analysis of the above regression model for the study. The ANOVA shows the overall fitness of the regression model. We can observe that the p-value (significance) is less than .05 (5 percent) hence, we can say that the regression model can be accepted and is statistically fit.

Table 7

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df[1]	df[2]	Sig. F Change
1	.993a	.986	.968	136,378.674	.986	55.093	5	4	.001

Table 7 shows the summary of the regression model of the study. Here, we find that the R value is .993 which means that there is a strong positive linear relationship between the independent and dependent variable of the model. We also observe that the R Square is .986; this means that 98.6% of the dependent variable is explained by the independent variables of the study. This is an exceptionally high R Square value and suggests that the regression model does an excellent job of explaining the variability in the data.

Conclusion

In conclusion, this study aimed to find the relationship and impact of certain macroeconomic variables in the cement consumption of Nepal. The findings of the study shows that Gross Domestic Product, Government Capital Expenditure and Remittance Inflow have a significant relationship with the domestic cement consumption of Nepal. And interest rate does not have a significant relationship with domestic cement consumption. The direction of the finding of this study for Gross Domestic Product is in similar directions with the findings of study conducted in (DOI, 2019).

The equation that explains the cement consumption is $Y = 4{,}991{,}568.15 + 1.62*X_1 + 11.98*X_2$ where Y is the dependent variable (i.e., domestic cement consumption in metric ton), X_1 is the gross domestic product (in NPR million) and X_2 is the government capital expenditure (in NPR million). The future cement consumption patterns can be forecasted for managerial implications, future research or policy making using the above equation and factoring estimated gross domestic product and government capital expenditure figures.

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